4-3: Cramer's Rule

The solution (x, y, z) for a system of 3 linear equations is $\left(\frac{D_x}{D}, \frac{D_y}{D}, \frac{D_z}{D} \right)$

D = coefficients determinant

D_x, D_y, and D_z are determinants formed by replacing coefficients in x, y, and z columns in D with the constants

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1 Solve by Cramer's Rule:

$$3x - 5y = 11$$
$$4x + 6y = -8$$

$D = \begin{vmatrix} 3 & -5 \\ 4 & 6 \end{vmatrix} = 18 + 20 = 38$

$D_x = \begin{vmatrix} 11 & -5 \\ -8 & 6 \end{vmatrix} = 66 - 40$
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$D_y = \begin{vmatrix} 3 & 11 \\ 4 & -8 \end{vmatrix} = -24 - 44 = -68$

$\left(\frac{26}{38}, \frac{-68}{38} \right) = \left(\frac{13}{19}, \frac{-34}{19} \right)$

2 **Solve by Cramer's Rule:**

$$x + 2y - z = 4$$

$$3x - 2y = 6$$

$$-4x + 3z = -5$$

$$D = \left|\begin{array}{ccc|cc} 1 & 2 & -1 & 1 & 2 \\ 3 & -2 & 0 & 3 & -2 \\ -4 & 0 & 3 & -4 & 0 \end{array}\right| = -6+8-18$$

$$= -16$$

$$D_x = \left|\begin{array}{ccc|cc} 4 & 2 & -1 & 4 & 2 \\ 6 & -2 & 0 & 6 & -2 \\ -5 & 0 & 3 & -5 & 0 \end{array}\right| = -24+10-36 = -50$$

$$D_y = \left|\begin{array}{ccc|cc} 1 & 4 & -1 & 1 & 4 \\ 3 & 6 & 0 & 3 & 6 \\ -4 & -5 & 3 & -4 & -5 \end{array}\right|$$

$$18+15-24-36 = -27$$

$$D_z = \left|\begin{array}{ccc|cc} 1 & 2 & 4 & 1 & 2 \\ 3 & -2 & 6 & 3 & -2 \\ -4 & 0 & -5 & -4 & 0 \end{array}\right| = 10-48-32+30$$

$$-40$$

$$\left(\frac{25}{8}, \frac{27}{16}, \frac{5}{2}\right)$$